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by Edward Ng

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Canadian Health Measures Survey: A tool for immigrant health research?

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Abstract

Background
The Canadian Health Measures Survey (CHMS) fills important health information gaps, but the feasibility of using it for immigrant research is unknown.

Data and methods
Weighted estimates of socio-demographic variables by immigrant status from the combined cycles 1 and 2 of the CHMS (2007 to 2009 and 2009 to 2011) were compared with distributions from the 2006 Census and the 2011 National Household Survey (NHS). Weighted CHMS estimates of selected self-reported health indicators among immigrants were compared with corresponding data from the 2009/2010 Canadian Community Health Survey (CCHS) by age group, sex, broad world region of origin, and period of arrival. Z-scores were used to detect statistical significance between the CHMS and CCHS estimates.

Results
The CHMS immigrant sample is generally similar to the average of 2006 Census/2011 NHS samples, but it contains higher percentages of recent immigrants, 30- to 49-year-olds, and immigrants from South/Central America. Estimates of selected self-reported health and health behaviour variables from the CHMS and the CCHS were similar overall, with minor differences at subgroup levels, and some inconclusive results due to high variability.

Interpretation
The combined CHMS immigrant sample can be used for health research. However, it is necessary to ensure that variables of interest meet sample size and prevalence requirements, especially at the subgroup level.

Keywords
Birthplace, data pooling, health surveys, physical health measures

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The Canadian Health Measures Survey (CHMS) is unique in providing direct physical health measures that address data gaps in existing information. However, the feasibility of using the CHMS for immigrant research has not been established. A small number of studies based on cycle 1 of the CHMS included immigrant status (or foreign-born),[1-4] but not by source country or period of arrival.

The release of cycle 2 of the CHMS in 2013 made it possible to combine data from the two cycles to obtain a larger sample, and thereby present more precise prevalence estimates[5] and more detailed analyses[6] of immigrant health. For instance, a recent study of Hepatitis B and C, which pooled the two cycles, concluded that the CHMS representation of world regions such as China and Africa is similar to overall 2006 Census estimates.[5] However, a systematic evaluation of the suitability of the CHMS, which includes a comparison with the 2011 National Household Survey (NHS), is necessary.

The present study evaluates the representativeness of the pooled 2007/2009-2009/2011 CHMS immigrant sample by comparing it with socio-demographic distributions from the 2006 Census and the 2011 NHS, and with selected self-reported health and health behaviour indicators from the 2009/2010 Canadian Community Health Survey (CCHS). The aim is to understand the strengths and limitations of the combined CHMS data for analysis of immigrant health.

Data and methods

Data sources

Four Statistics Canada's datasets were used in this study: the combined 2007/2009 and 2009/2011 CHMS, the 2006 Census, the 2011 NHS, and the 2009/2010 CCHS.

The CHMS is conducted by Statistics Canada in collaboration with the Public Health Agency of Canada and Health Canada. It was designed to produce estimates that are representative of the national population, but not of subgroups such as immigrants. The survey involves an in-person interview to gather socio-demographic, health and lifestyle information, and a subsequent visit to a mobile examination centre for direct physical measures. From March 2007 through February 2009, cycle 1 collected information from 5,604 respondents aged 6 to 79 living in private dwellings in 15 locations across Canada. From August 2009 through November 2011, cycle 2 collected information from 6,395 respondents aged 3 to 79 living in private dwellings in 18 locations. People living

in the territories, on reserves and in other Aboriginal settlements in the provinces, full-time members of the Canadian Forces, the institutionalized population, and residents of some remote regions were excluded. Ethics approval was obtained from Health Canada's Research Ethics Board.[7]

This study pooled data from cycles 1 and 2 to increase the sample size, and thereby, increase the diversity of the data and the precision of the estimates. The combined response rate was 53.5%. Out of a total of 11,385 respondents in the combined cycles, 2,078 (18.2%) were immigrants. Details about the CHMS[8-11] and an explanation of the steps involved in combining cycles[6] are available elsewhere.

The CHMS data pertain to the 2007-to-2011 period. Therefore, to evaluate the overall representativeness of the CHMS by immigrant status, this study compared the socio-demographic and immigrant-related weighted CHMS estimates with the average of the corresponding weighted estimates from the 2006 Census and the 2011 NHS for people aged 6 to 79 in private households.

Between May 1 and May 13 of 2006, households in Canada received a mandatory Census of Population questionnaire. The short questionnaire contained eight questions and was completed by 80% of households. The long questionnaire, which was completed by 20% of households and which was used in this analysis, contained those eight questions and an additional 53, some of which were immigrant-related.

The NHS, which replaced the long-from Census, was conducted from May to August 2011 as a voluntary survey. A random sample of 4.5 million dwellings, about 30% of all private dwellings, was selected. The response rate was 68.6%.

The final weighted 2006 Census and NHS estimates for immigrants were verified by comparisons with other sources of immigrant data. Out of 11,753,875 respondents aged 6 to 79 in the 2006 Census/2011 NHS, 2,410,131 (21%) were immigrants. Details about the 2006 Census and the NHS are available elsewhere.[12,13]

The CCHS is a cross-sectional survey that collects information about health status, health care use and health determinants. It is designed to provide reliable estimates at the health region level and has been used to study immigrant health.[14,15] CCHS data are collected from people aged 12 or older living in private dwellings in all provinces and territories. Like the CHMS, the CCHS excludes residents of reserves and institutions and full-time members of the Canadian Forces. The combined response rate for the 2009/2010 CCHS was 72.3%. Out of 124,870 respondents, 17,863 (14%) were immigrants. The 2009/2010 CCHS data were used to compare self-reported health estimates with those of the CHMS. Details about the CCHS are available elsewhere.[16]

Variables

Both the CHMS and CCHS defined an immigrant as a person born outside Canada who was not born a Canadian citizen. The 2006 Census/2011 NHS defined an immigrant as someone who is not a Canadian citizen by birth, but who has been granted the right to live in Canada permanently by Canadian immigration authorities.[17]

Basic socio-economic and demographic comparisons between the combined 2007/2009-2009/2011 CHMS and the 2006 Census/2011 NHS for the population aged 6 to 79 were derived by immigrant status (immigrant versus non-immigrant) for the following variables: mean age, age distribution (6 to 29, 30 to 59, and 60 to 79), sex, and percentage with secondary school graduation (people aged 30 or older). Immigrants were classified by period of arrival (1996 or later, 1986 to 1995, or before 1986), and by world region of origin (United States, South/Central America including the Caribbean, Europe, Africa, Asia, and Oceania).

The Census/NHS results are based on large samples with narrow confidence intervals at the national level. Therefore, statistical comparisons with the CHMS follow the common practice of determining whether the Census/NHS estimates lie within the confidence intervals of the CHMS estimates.[6]

Self-reported health and health behaviour variables for comparisons between the CHMS and the CCHS were chosen according to two criteria. First, the variables had to be measured with the same instrument in both surveys. Second, for cycle 1 of the CHMS, the sample size required to obtain national estimates for a prevalence of at least 10%, with a coefficient of variation (CV) of 16.5% or less, is 500, assuming a design effect of 1.5. This implies that when the two CHMS cycles were combined, the sample size required to obtain national estimates for a prevalence of 5% or more, would be 1,000.

Design effect is the ratio of the variance of the complex survey design to that of the simple random survey; it is a measure of survey design efficiency. The CV is the ratio of the standard deviation to the mean; it is a measure of dispersion. In the tables, estimates with a CV between 16.5% and 33.3% are flagged with an E; those with a CV that exceeds 33.3% are not releasable and are designated F.

The health status indicators selected were self-rated health and self-rated mental health for ages 12 to 79, and high blood pressure diagnosed by a health professional for ages 30 to 79.

Self-reported health is strongly associated with morbidity, mortality and use of health services.[18,19] Self-reported mental health is especially important for immigrants, given that they face adjustment issues that can have mental health consequences.[20,21] For this study, ratings of health and mental health were collapsed from five to two categories: good (excellent, very good or good) and poor (fair or poor).[20,22,23] High blood pressure was chosen because it is a major risk factor for heart disease and stroke; the analysis was restricted to people aged 30 to 79, among whom the condition is more prevalent.[24,25]

The health behaviour indicators selected were current smoking for ages 12 to 79,[26] and obesity for ages 18 to 79.[27]

For each indicator, percentages were derived from the CHMS and the CCHS, by age and sex, and for immigrants, by world region of origin and period of arrival. Z-scores were used to detect sta-

tistically significant differences between the two surveys. In all rate comparisons, the significance level was set at 0.05, with standard errors based on bootstrap weights using SUDAAN-callable SAS v 9.2.[28,29] The number of degrees of freedom for the CHMS was specified as 24.[6]

Results

Comparisons with Census/NHS

Socio-demographic characteristics

An estimated 23% (95% CI: 17.8-29.2) of the CHMS population were immigrants; the corresponding figure based on the 2006 Census and 2011 NHS was 21% (Table 1). The mean age of the CHMS immigrant population was 44 (95% CI: 42.9-45.4), compared with 45 in the Census/NHS. According to the CHMS, 51% of immigrants were males; the Census/NHS figure was 48%. The percentage of immigrants who were secondary school graduates was 82% in the CHMS and 80% in the Census/NHS.

Although the mean age of immigrants in the two sources was almost the same, a difference emerged in age distributions: the CHMS immigrant population was somewhat "younger." For the 30-to-49 age group, the Census/NHS estimate of 37.7% was below the CHMS confidence interval (42.4%, 95% CI: 38.4-46.4); for the 50-to-79 age group, the Census/NHS estimate of 42.3% was higher than the CHMS confidence interval (36.6%, 95% CI: 32.6-40.7).

Table 1
Comparison of selected characteristics in 2007/2009-2009/2011 Canadian Health Measures Survey (CHMS) pooled sample with average of 2006 Census and 2011 National Household Survey (NHS) estimates, by immigrant status, household population aged 6 to 79, Canada

	Immigrants				Non-immigrants			
	CHMS				CHMS			
		95% confidence interval		Census/		95% confidence interval		Census/
Characteristics		from	to	NHS		from	to	NHS
Distribution (%)	23.0	17.8	29.2	21.3	77.0	70.8	82.2	78.6
Mean age (years)	44.1	42.9	45.4	45.4	38.2	37.6	38.8	38.3
Age group (%)								
6 to 29	21.1	18.4	24.1	20.0	38.2	36.7	39.6	37.3
30 to 49	42.4	38.4	46.4	37.7*	30.6	28.8	32.4	30.8
50 to 79	36.6	32.6	40.7	42.3*	31.3	29.5	33.1	31.9
Males (%)	50.9	46.9	54.9	48.1	49.5	48.3	50.7	49.7
At least secondary school graduation (age 30 or older)(%)	81.6	76.8	85.6	80.0	79.9	77.8	82.0	77.4*
World region of origin (%)								
United States	5.7E	3.9	8.3	3.8	...	...	...	...
South/Central America and Caribbean	15.9	13.2	18.9	11.9*	...	...	...	...
Europe	29.9	22.9	38.1	32.7	...	...	...	...
Africa	5.7E	4.1	8.1	6.8	...	...	...	...
Asia	41.5	32.2	51.4	43.9	...	...	...	...
Oceania	F	...	...	0.9	...	...	...	...
Period of arrival (%)								
1996 or later	44.4	39.9	48.9	38.4*	...	...	...	...
1986 to 1995	19.8	17.1	22.9	22.7	...	...	...	...
Before 1986	35.8	30.7	41.4	38.8	...	...	...	...

* outside CHMS confidence interval

E use with caution

F too unreliable to be published

... not applicable

Sources: 2007/2009 and 2009/2011 Canadian Health Measures Survey, combined; 2006 Census long-form 2B and 2011 National Household Survey.

World region and period of immigration

The distributions of immigrants by world region of origin were similar in the CHMS and the Census/NHS. According to the CHMS, Asia accounted for the largest percentage of immigrants (42%), followed by Europe (30%), South/Central America (16%), and the United States and Africa (both 6%). The corresponding Census/NHS figures were 44%, 33%, 12%, 4% and 7%. CHMS over-coverage was detected for immigrants from South/Central America.

By period of arrival, the distributions of immigrants were similar, except for an overestimation of recent immigrants (1996 or later) in the CHMS (44.4%, 95% CI: 39.9-48.9), compared with the Census/NHS (38%).

Comparisons with CCHS

Health outcomes

The estimated prevalence of good self-rated health among immigrants aged 12 to 79 was almost the same in the 2007/2009-2009/2011 CHMS and the 2009/2010 CCHS data (Table 2). According to the CHMS, 90% of immigrants reported good health, compared with 89% in the CCHS. As well, estimates of the prevalence of good health among immigrants were generally similar by age, sex, world region of origin and period of arrival. The exceptions were immigrants aged 50 to 79 (85% in the CHMS versus 81% in the CCHS) and immigrants from Africa (97% versus 91%).

The prevalence good self-rated mental health among immigrants was 96% based on the CHMS and 95% based on the CCHS (Table 2). All estimates for immigrants were comparable between the two surveys overall, and by the selected covariates, except for immigrants from Africa and for those who arrived in the 1986-to-1995 period.

According to both surveys, 22% of immigrants aged 30 to 79 had been diagnosed with high blood pressure. Owing to high CVs, it was not possible to make conclusive comparisons for most world regions of origin and for recent immi-

Table 2
Prevalence of self-reported good health, good mental health and high blood pressure among immigrants, by selected characteristics, 2007/2009-2009/2011 Canadian Health Measures Survey (CHMS) and 2009/2010 Canadian Community Health Survey (CCHS), household population aged 12 to 79, Canada

	CHMS			CCHS		
		95% confidence interval			95% confidence interval	
Characteristics	%	from	to	%	from	to
Good health	**89.6**	**87.0**	**91.7**	**88.5**	**87.6**	**89.3**
Age group						
12 to 29	94.7	91.5	96.7	96.7	95.7	97.5
30 to 49	91.5	86.7	94.7	91.9	90.5	93.1
50 to 79	84.8	80.6	88.2	80.8*	79.2	82.2
Sex						
Male	90.5	86.9	93.2	88.8	87.5	89.9
Female	88.7	84.7	91.7	88.2	87.0	89.2
World region of origin						
United States	94.6	87.7	97.7	91.4	87.8	94.1
South/Central America and Caribbean	88.8	80.8	93.7	88.3	85.9	90.4
Europe	88.5	85.0	91.2	85.8	84.5	87.0
Africa	97.0	87.5	99.3	90.7*	87.5	93.1
Asia	88.8	83.7	92.4	89.7	88.2	91.1
Period of arrival						
1996 or later	94.0	88.6	96.9	92.6	91.2	93.9
1986 to 1995	88.1	78.5	93.8	89.1	87.2	90.7
Before 1986	85.3	81.1	88.7	83.4	82.0	84.7
Good mental health	**95.6**	**93.6**	**97.0**	**95.0**	**94.4**	**95.5**
Age group						
12 to 29	93.9	87.2	97.2	97.0	95.8	97.9
30 to 49	96.4	92.6	98.3	94.9	93.9	95.8
50 to 79	95.5	91.9	97.6	94.0	93.1	94.8
Sex						
Male	95.8	93.3	97.4	95.3	94.5	96.0
Female	95.4	91.5	97.6	94.7	93.9	95.4
World region of origin						
United States	91.7	72.9	97.9	96.2	94.3	97.4
South/Central America and Carribean	96.9	91.6	98.9	94.8	93.0	96.2
Europe	96.2	91.4	98.3	94.7	93.9	95.5
Africa	98.9	96.4	99.7	95.5*	92.9	97.2
Asia	95.3	92.6	97.0	95.1	94.1	96.0
Period of arrival						
1996 or later	95.8	93.3	97.3	95.9	95.0	96.7
1986 to 1995	97.9	95.5	99.0	94.8*	93.3	95.9
Before 1986	94.2	89.5	96.8	94.1	93.2	94.9
High blood pressure (ages 30 to 79)	**22.3**	**18.3**	**27.0**	**21.5**	**20.4**	**22.6**
Age group						
30 to 49	12.7E	7.5	20.6	8.2	7.0	9.6
50 to 79	33.4	28.7	38.5	34.7	33.0	36.4
Sex						
Male	27.8	20.7	36.4	21.8	20.3	23.4
Female	16.6	13.1	20.8	21.1*	19.6	22.8
World region of origin						
United States	22.2E	13.0	35.4	19.2	14.7	24.7
South/Central America and Caribbean	21.8E	13.7	32.9	20.2	17.0	24.0
Europe	27.7	22.5	33.5	26.6	24.9	28.4
Africa	F	...	...	16.1	12.1	20.8
Asia	19.9E	12.7	29.8	18.4	16.6	20.4
Period of arrival						
1996 or later	12.8E	6.4	24.1	12.8	10.9	14.9
1986 to 1995	16.1	12.5	20.4	18.3	15.7	21.2
Before 1986	32.7	27.8	38.1	29.2	27.7	30.7

* significantly different from CHMS ($p < 0.05$)
E use with caution
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... not applicable
Sources: 2007/2009 and 2009/2011 Canadian Health Measure Survey, combined; 2009/2010 Canadian Community Health Survey.

grants. The remaining estimates of the prevalence of high blood pressure were generally similar, except for immigrant women, among whom the prevalence of high blood pressure was 17% according to the CHMS, but 21% according to the CCHS.

Health behaviours

Based on self-reports to the CHMS, 12% of immigrants aged 12 to 79 were current smokers, compared with 14% according to the CCHS (Table 3). However, the CHMS found 15% of immigrant males to be current smokers, significantly below the 21% reported by the CCHS. As reflected in high CVs, some comparisons between the two surveys were inconclusive.

CHMS and CCHS estimates of the prevalence of obesity were almost the same: 13% and 12%, respectively. Although all estimates of obesity by subgroup were similar, high sampling variability meant that most comparisons were not meaningful.

Discussion

The comparison with Census/NHS results shows that while the pooled CHMS dataset is generally representative of the immigrant population, it over-represents immigrants who arrived after 1995, those aged 30 to 59, and immigrants from South/Central America. Data weighting to provide national baseline estimates of key variables partly explains why the socio-demographic characteristics in the CHMS and the Census/NHS were comparable for non-immigrants, but less so for immigrants.[9,10] Over-coverage of recent and younger immigrants in the CHMS likely reflects the cluster survey collection methodology: the sites selected for mobile examination centres had to be within commuting distance for respondents, which would more likely be in or near urban centres where the majority of new and younger immigrants reside.[9,10]

In light of the over-coverage of recent and younger immigrants, better health outcomes among immigrants might be expected based on CHMS results. However, the CHMS and CCHS data showed similar overall results for the five health status and health behaviours examined. At more detailed levels of analysis, such by age group or by world region, differences between the two data sources were apparent.

Although the CHMS was not designed to prevalence estimates for subgroups such as immigrants, results from the CHMS and the CCHS for the selected health outcomes were similar. Thus, the sample of 2,078 immigrants obtained by combining the two CHMS cycles, although small, is nationally representative and can be used for immigrant health research. However, care should be exercised:

- The slightly younger age distribution of the CHMS immigrant sample suggests that adjustments for age may be necessary. The over-coverage of immigrants from South/Central America warrants caution if the variable of interest is prevalent in this subgroup. This also applies to the over-coverage of recent immigrants.

Table 3
Prevalence of smoking and obesity among immigrants, by selected characteristics, 2007/2009-2009/2011 Canadian Health Measures Survey (CHMS) and 2009/2010 Canadian Community Health Survey (CCHS), household population aged 12 to 79, Canada

	CHMS			CCHS		
		95% confidence interval			95% confidence interval	
Characteristics		from	to		from	to
Current smoker	**12.0**	**9.6**	**14.8**	**14.4**	**13.4**	**15.4**
Age group						
12 to 29	12.4[E]	7.1	20.9	13.9	11.9	16.0
30 to 49	13.3[E]	9.0	19.1	16.3	14.7	18.1
50 to 79	10.2	7.9	13.1	12.7	11.4	14.2
Sex						
Male	15.0	12.4	18.0	20.6*	19.0	22.3
Female	8.8[E]	5.9	13.1	8.3	7.3	9.3
World region of origin						
United States	10.8[E]	5.8	19.1	15.7	12.3	19.9
South/Central America and Carribean	14.1[E]	7.7	24.5	13.3	10.8	16.3
Europe	13.4	9.7	18.3	17.5	16.0	19.2
Africa	15.8[E]	7.8	29.4	14.4	11.3	18.2
Asia	9.4[E]	6.6	13.4	12.3	10.9	13.8
Period of arrival						
1996 or later	12.1	8.6	16.7	13.7	12.2	15.3
1986 to 1995	12.0[E]	7.1	19.5	15.9	13.8	18.4
Before 1986	11.8	8.8	15.8	14.3	12.9	15.7
Obese (ages 18 to 79)	**12.2**	**9.3**	**15.9**	**13.0**	**12.2**	**13.9**
Age group						
18 to 29	F	...	...	7.4	5.8	9.5
30 to 49	11.5[E]	6.7	19.1	11.7	10.4	13.1
50 to 79	15.2	11.8	19.4	16.6	15.2	18.1
Sex						
Male	12.2[E]	8.3	17.6	14.3	12.9	15.8
Female	12.3[E]	8.6	17.3	11.7	10.7	12.8
World region of origin						
United States	18.4[E]	10.1	31.2	23.3	17.3	30.7
South/Central America and Carribean	13.3[E]	8.2	20.9	16.9	13.8	20.4
Europe	16.9	13.8	20.5	16.3	14.9	17.9
Africa	14.2[E]	6.2	29.3	18.2	14.3	22.8
Asia	7.4[E]	3.8	14.1	7.3	6.2	8.5
Period of arrival						
1996 or later	F	...	...	9.3	7.9	10.8
1986 to 1995	F	...	...	12.0	10.2	14.0
Before 1986	16.8	13.7	20.3	13.4	15.9	18.9

* significantly different from CHMS ($p < 0.05$)
[E] use with caution
F too unreliable to be published
... not applicable
Sources: 2007/2009 and 2009/2011 Canadian Health Measure Survey, combined; 2009/2010 Canadian Community Health Survey

What is already known on this subject?

- Few previous studies have used the Canadian Health Measures Survey (CHMS) to study immigrant health outcomes, partly because of small sample sizes.
- A recent analysis concluded that combined cycle 1 and cycle 2 CHMS data are representative of immigrant populations from countries or areas with high risk of Hepatitis B and C (South America, Africa, China/Hong Kong).
- A systematic evaluation of the overall suitability of the CHMS for immigrant research is needed.

What does this study add?

- Comparisons with data from the 2006 Census and the 2011 National Household Survey show that the combined CHMS data are generally representative of the immigrant population in Canada.
- Estimates of selected self-reported health and health behaviour indicators from the CHMS and the Canadian Community Health Survey were similar overall, but minor differences at subgroup levels were apparent, as well as inconclusive results due to high sampling variability.
- The CHMS is suitable for immigrant health research provided that the variables of interest meet sample size and prevalence requirements.

- Owing to sample size limitations, CHMS estimates for immigrant subgroups become less stable, and CVs larger. Based on the guidelines for cycle 1, when cycles 1 and 2 are combined, a sample size of 1,000 is needed to obtain releasable national-level estimates for a prevalence of at least 5%. Consequently, the use of the combined cycles for detailed studies of relatively rare conditions among immigrants would be challenging.
- Whether the CHMS can be used for analyses at the source-country level depends on the sample size and the prevalence of the conditions studied. Combining future CHMS cycles is a possibility; for example, researchers in the United States applied this approach to the National Health and Nutrition Examination Survey to conduct immigrant health research.[30] However, this may not be feasible for indicators such as smoking behavior that change over time.

Limitations

The results of this study should be considered in the light of several limitations. The CHMS used cluster samples of 33 collection sites chosen over two survey cycles. Logistical and budget constraints limited the number of sites and sample size. The CHMS was not designed to target areas with high immigrant populations.

Survey weights for the CHMS were calculated to ensure that the sample is representative of the national population in terms of socio-demographic characteristics, but differences in health indicators could not be taken into account. Bias may exist if the health status and health behaviours of respondents differed systematically from those of non-respondents.

Despite their much larger samples, the Census/NHS and the CCHS are subject to sampling and non-response errors. Nonetheless, for this study, they were used as the "true" values. Averaging the 2006 Census and the 2011 NHS estimates to approximate population characteristics in 2008 assumes steady population growth and disregards fluctuations in births, deaths, immigration, and emigration. An alternative—the use of inter-censal population estimates—would not include the immigrant-related characteristics such as world region of origin that were essential to this analysis.

Conclusion

The present study is the first to assess the adequacy of pooled 2007/2009-2009/2011 CHMS data for immigrant health analyses. With minor exceptions, these data are representative of the immigrant population aged 6 to 79, and can be used for immigrant health research, notably, the direct physical measures that are collected only by the CHMS. However, it is necessary to determine if variables of interest meet sample size and prevalence requirements, especially for subgroups. ■

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